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Operation of a conventional Type III exit hatch: Passenger perceptions and performance

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Type III Exit operating mechanism

- Unlike main airframe doors, Type III exit hatches are not attached to airframe.
- Once released, the hatch must be brought inside fuselage and rotated, before being thrown onto the wing.

Intended operators

- Type III exits are intended to be operated by passengers who have been screened for their suitability to sit in the exit row.
- Nevertheless, the operating mechanism of the hatch has led to passengers having problems in opening the hatch and disposing of it correctly.
- This was the case at Manchester in 1985, where a passenger tried to open the Type III exit using the attached armrest.

Automatic Hatch Disposal (ADH)

- New Type III exit operating mechanism designed by Boeing.
- Incorporates automatic hatch disposal.
- In service on new 737 derivatives.

Automatic Hatch Disposal (2)

- Likely to improve the probability that the Type III exit can be made available quickly & accurately in the event of an emergency situation.
- Initially, more likely to be required on newly manufactured aircraft.
- However, conventional Type III exits are fitted to a large number of in-service aircraft.

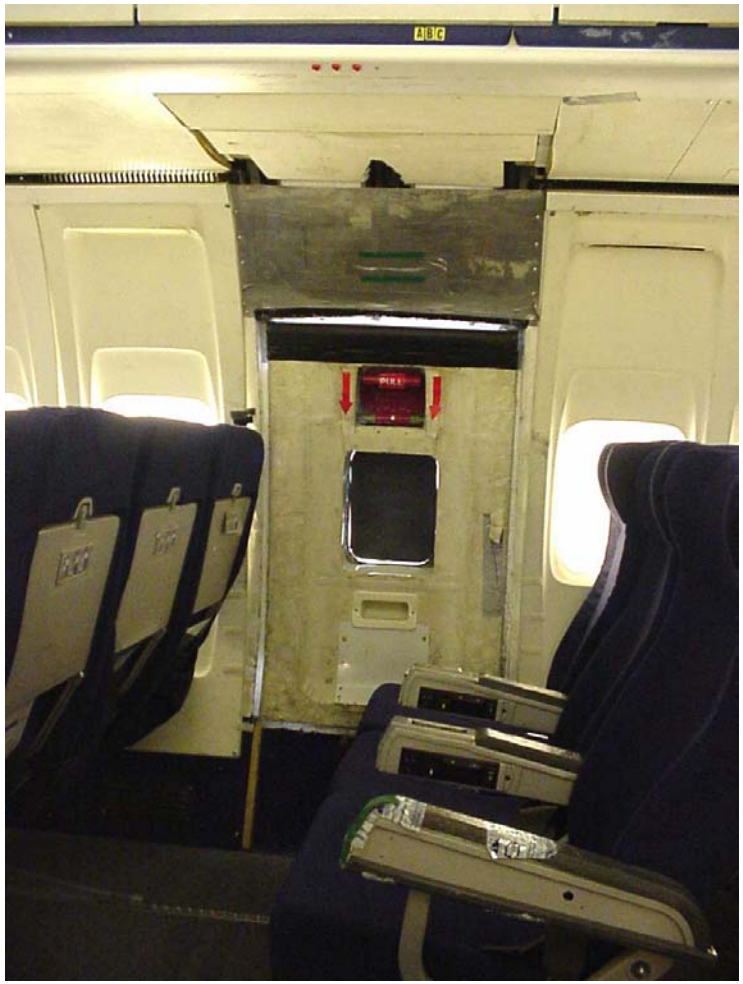
Type III exit operator performance

Three studies on Type III exit operator perceptions and performance:

- Passenger perceptions of exit operation task in different seating configurations.
- Influence of cabin crew located at Type III exit.
- Influence of different methods of briefing exit row passengers.

Boeing 737 Cabin Simulator

Type III Exit



Study 1

- Qualitative research intended to investigate, in detail, passenger perceptions of the Type III exit operation task under various seating configurations.
- Also intended to obtain suggestions from naïve exit operators on possible improvements.

Method

- Seven groups of up to nine participants, randomly allocated to seats.
- Seven seating configurations: 6”OSR, 7”, 10”, 13”, 18”, 20” or 25” vertical projections.
- Each group received a pre-flight safety briefing from a member of cabin crew.
- The passenger seated next to the Type III exit also received a personal, minimum briefing from cabin crew.

Data collection

- Once the evacuation was complete, the passengers returned to the cabin for an in-depth group interview.
- The interview was semi-structured, so the researcher had a list of topics to be covered.
- On completion, all of the interviews were transcribed and analysed.

Comments on the hatch itself (1)

- "It's so similar to the rest of the wall that in bad lighting, at a glance, if you didn't see this red bit here (pointing to upper handle), you might not see it!"

Comments on the hatch itself (2)

- "I don't know why the whole door isn't red, or a fluorescent colour or something, so that straight away you think '*that has got to be the exit*'"

Comments on hatch operation (1)

- "I did not expect it to come to me first, and once I released it, I thought if anything it would be trying to fall away from me, but it needed to come forward first of all"

Comments on hatch operation (2)

- "I would expect it to go out… I would always expect a door to go out. I would never imagine a door to go in…"

Comments on hatch operation (3)

- "I was expecting the door to have some kind of hinge to take the weight… well, like a normal door I suppose, and all I would have to do would be to push it out of the way… I was surprised it was a pull out door"

Comments on hatch operation (4)

- "But in a way, before you can go out, you've got to come back in! Only for a second, but when you are faced with death it doesn't feel like you should do that… you are panicking, and you don't think to go back in!"

Comments on hatch weight

- "What surprised me was the weight of the door, pulling it out was no problem, but as soon as you tilt it, literally, as you turn it, the weight of it comes into play"

Seating configurations (1)

- "I was bent over double, struggling with it at about knee level, which did not help at all" (6" OSR)
- "There was just no space to move… it's hard, because it comes inwards… and you are trying to chuck it out at the same time" (7" vertical projection)

Seating configurations (2)

- "It's a little bit difficult having to twist and pull, having to jiggle it around and then get it out… it is difficult… you need a lot of space to move to do that in" (20" vertical projection)
- "You need more space to get the door out" (25" vertical projection)

Comments on the safety information (1)

- "By the look of the pictures… there are nice clips of the lady there and it's nicely supported and it's swinging out beautifully… it's not like that!"

Comments on the safety information (2)

- "If you do a video, don't do one that shows it all smooth and beautiful, to give the illusion that it's an easy thing to do… so show that it's heavy, show that it might get stuck, show the things that are potential things that can happen… and not have it all pink and flowery!"

Comments on passenger responsibilities (1)

- "I've been on a few planes, and sat by the exit a few times… you just automatically presume that the staff on the plane will do it… you think they know all the ins and outs"

Comments on passenger responsibilities (2)

- "Even if you're sat next to it, you think, no, no… cabin crew will miraculously appear in front of you and do it!"

Comments on passenger responsibilities (3)

- "Perhaps another member of cabin crew sitting up near the door would have helped"

Comments on passenger responsibilities (4)

- "If you are going to put cabin crew there, you might as well seat one here (in the exit seat)… someone who knows what they are doing, someone who doesn't have to think about it".

Study 2

- Funded by Transport Canada to evaluate the benefit of having an additional member of cabin crew located near the Type III exit.
- Involved the conduct of group evacuation trials with up to 48 “passengers”.
- Cabin crew near the exit provided instruction and guidance during the evacuation on how to operate and dispose of the Type III hatch.

Method

- Passengers required to evacuate the 737 cabin simulator through the Type III exit.
- In all conditions, two members of cabin crew were located in the front and rear of the cabin.
- In conditions where a third member of cabin crew was available at the Type III exit, this crew member was seated behind the exit operator.

Results

Time taken to make the Type III exit available was split into:

- ***Reaction time*** - time taken from call to evacuate to placing hand on operating handle.
- ***Exit operation time*** - time taken from placing hand on handle, to hatch being placed on wing.

Exit Availability Times

	Cabin crew at Type III exit (5 evacuations)	No cabin crew at Type III exit (6 evacuations)
Mean reaction time	1.65 seconds*	3.18 seconds*
Mean exit operation time	5.13 seconds	4.12 seconds
Mean total exit availability time	6.78 seconds	7.30 seconds

* Statistically significant difference

Study 3

- Funded by the UK Civil Aviation Authority, to investigate the effectiveness of four different methods of briefing passengers in the Type III exit row.
- Involved 28 groups of 2 males and 1 female, and 28 groups of 2 females and 1 male.
- Minority sex participant was seated next to the Type III exit in all instances.

No briefing condition

- Participants received only the pre-flight safety briefing, and received no additional information on how to operate the Type III exit, or where to find the instructions.

Minimum briefing condition

- Participants received the pre-flight safety briefing.
- In addition, participants were told that they were seated next to an emergency exit, and that they may have to operate the exit in the event of an emergency.
- Participants were also told about the instructions on the safety card, and the placards on the seat backs in front of them.

Oral briefing condition (1)

- Participants received the pre-flight safety briefing.
- Participants were also told that they were seated next to an exit that they may have to open in the event of an emergency, and shown the instructions.
- Participants were informed of when the exit should be operated, and how to operate it.

Oral briefing condition (2)

- Participants were informed that the exit was a hatch, not a hinged door.
- The upper and lower handles were pointed out to participants.
- Participants were informed of the weight of the hatch, and were told of the requirement to throw it outside the fuselage.

Written briefing condition

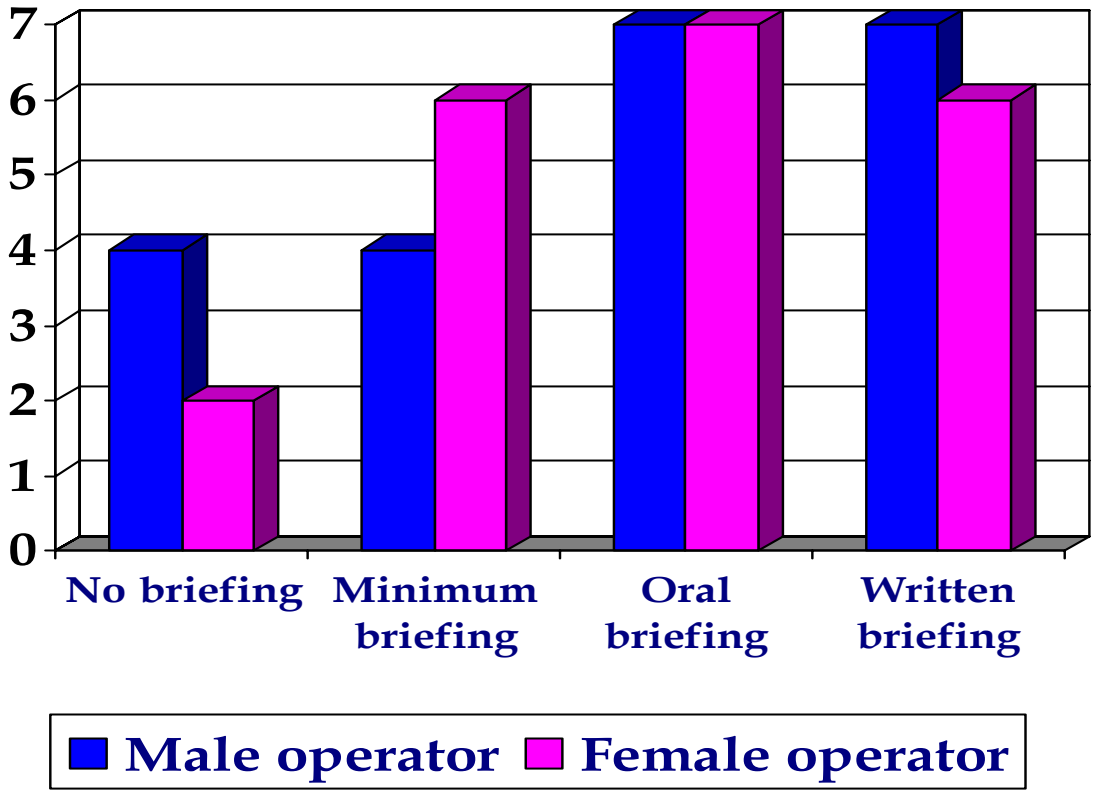
- Participants received the pre-flight safety briefing.
- In addition, participants were provided with the same comprehensive information as in the verbal condition, with the exception that the information was presented in writing.

Results - Speed of Performance

	No briefing	Minimum briefing	Oral briefing	Written briefing
Mean reaction time	7.7 seconds	5.4 seconds	3.8 seconds*	2.9 seconds*
Mean exit operation time	6.9 seconds	7.1 seconds	7.7 seconds	6.8 seconds
Mean exit availability time	14.4 seconds	12.5 seconds	11.5 seconds	9.7 seconds*

* Statistically significant difference

Results – Accuracy of Performance (Placing hatch outside fuselage)



Conclusions (1)

- Passenger expectations of the exit operation task do not always reflect the reality of the situation.
- Additional steps to enhance the "emergency exit" status of the door could be beneficial.

Conclusions (2)

- Enhancing the safety information currently provided could be beneficial, in that it could warn passengers of the potential difficulties in opening the exit.
- Providing cabin crew with detailed briefing resources would enable them to give a fuller briefing to passengers.

Conclusions (3)

- In an emergency situation, cabin crew could increase the probability of making the Type III exit available quickly by calling instructions to passengers. This would be likely to reduce passenger hesitation times.